CLAIMS

1. An apparatus for planarizing a microelectronic substrate, comprising:

a platen having a support surface oriented at an angle offset from horizontal during operation;

a non-continuous polishing pad adjacent to the support surface of the platen and having a planarizing surface offset from horizontal and generally parallel to the support surface of the platen during operation; and

a substrate carrier at least proximate to the planarizing surface of the polishing pad, the carrier having at least one engaging surface for engaging the microelectronic substrate and biasing the microelectronic substrate against the polishing pad, at least one of the carrier and the polishing pad being movable relative to the other to remove material from the microelectronic substrate.

2. The apparatus of claim 1 wherein the support surface of the platen and the planarizing surface of the polishing pad are approximately vertical during operation.

3. The apparatus of claim 1 wherein the platen and the polishing pad each have a generally circular planform shape.

4. The apparatus of claim 1 wherein the polishing pad is an elongated non-continuous polishing pad, the apparatus further comprising:

a frame;

a supply spindle coupled to the frame and positioned to receive the elongated polishing pad;

a take-up spindle coupled to the frame and spaced apart from the supply spindle, the take-up spindle being positioned to receive a used portion of the elongated

polishing pad, the platen being coupled to the frame and positioned proximate to the supply spindle and the take-up spindle.

5. An apparatus for planarizing a microelectronic substrate, comprising:

a frame;

a supply spindle coupled to the frame and positioned to receive a non-continuous elongated polishing pad;

a take-up spindle coupled to the frame and spaced apart from the supply spindle, the take-up spindle being positioned to receive a used portion of the elongated polishing pad;

a platen positioned proximate to the supply spindle and the take-up spindle, the platen having a generally flat support surface for supporting a portion of the elongated polishing pad, the support surface being oriented at an angle offset from horizontal during operation; and

a substrate carrier at least proximate to a planarizing surface of the polishing pad when the polishing pad is installed on the spindles, the carrier having at least one engaging surface for engaging the microelectronic substrate and biasing the microelectronic substrate against the polishing pad, at least one of the carrier and the polishing pad being movable relative to the other to remove material from the microelectronic substrate.

6. The apparatus of claim 5 wherein the support surface of the platen is oriented approximately vertically during operation.

7. The apparatus of claim 5 wherein the support surface forms an angle of at least approximately 0.6 degrees relative to horizontal during operation.

8. The apparatus of claim 5 wherein the support surface forms an angle in the range of between approximately 0.6 degrees and approximately 1.2 degrees relative to horizontal during operation.

9. The apparatus of claim 5 wherein the supply spindle is positioned above the take-up spindle.

10. The apparatus of claim 5 wherein the take-up spindle is coupled to an actuator for rotating the take-up spindle relative to the frame.

11. The apparatus of claim 5, further comprising a ventilation supply port proximate to the supply spindle and a ventilation exit port proximate the take-up spindle for passing ventilation gas adjacent the polishing pad when the polishing pad is supported .

12. The apparatus of claim 11 wherein the polishing pad has a planarizing surface plane and the supply port directs the ventilation gas generally parallel to the planarizing surface plane.

13. The apparatus of claim 5, further comprising a pad conditioner positioned proximate to the polishing pad for conditioning a planarizing surface of the polishing pad.

14. The apparatus of claim 13 wherein the pad conditioner includes a plurality of orifices proximate to the polishing pad for directing a cleansing fluid toward the polishing pad.

15. The apparatus of claim 13 wherein the pad conditioner includes an end effector having a conditioning surface positioned to remove material from the

polishing pad, the end effector being coupled to an actuator for moving the end effector relative to the polishing pad.

16. The apparatus of claim 5, further comprising the elongated polishing pad, wherein the elongated polishing pad is attached at one end to a supply roll on the supply spindle and is attached at an opposite end to a take-up roll on the take-up spindle, the elongated polishing pad extending directly from the supply roll to the platen without passing adjacent another roller.

17. An apparatus for planarizing first and second microelectronic substrates, comprising:

a frame;

a first supply spindle coupled to the frame and positioned to receive a first elongated polishing pad;

a first take-up spindle coupled to the frame and positioned to receive a used portion of the first elongated polishing pad;

a second supply spindle coupled to the frame and positioned to receive a second elongated polishing pad;

a second take-up spindle coupled to the frame and positioned to receive a used portion of the second elongated polishing pad; and

a substrate carrier having a first portion and a second portion, the first portion being positioned proximate to the first polishing pad and having a first support surface positioned to engage a first microelectronic substrate and bias the first microelectronic substrate toward the first polishing pad, the second portion being positioned proximate to the second polishing pad and having a second support surface positioned to engage a second microelectronic substrate and bias the second microelectronic substrate toward the second polishing pad.

18. The apparatus of claim 17, further comprising:

a first platen positioned between the first supply spindle and the first take-up spindle, the first platen having a first engaging surface adjacent to the first polishing pad, the first polishing pad being positioned between the first platen and the first portion of the substrate carrier; and

a second platen positioned between the second supply spindle and the second take-up spindle, the second platen having a second engaging surface adjacent to the second polishing pad, the second polishing pad being positioned between the second platen and the second portion of the substrate carrier.

19. The apparatus of claim 17 wherein the first and second portions of the substrate carrier are coupled to a single actuator for moving the first portion cooperatively with the second portion.

20. The apparatus of claim 17 wherein the first portion of the substrate carrier is coupled to a first actuator and the second portion of the substrate carrier is coupled to a second actuator to move the first and second portions independently of each other.

21. The apparatus of claim 17 wherein the support surfaces of the first and second portions of the substrate carrier have an at least approximately vertical orientation.

22. The apparatus of claim 17 wherein the first supply spindle is positioned above the first take-up spindle.

23. The apparatus of claim 17 wherein the first take-up spindle is coupled to an actuator for rotating the first take-up spindle relative to the frame.

24. The apparatus of claim 17, further comprising a ventilation supply port proximate the first supply spindle and a ventilation exit port proximate the first take-up spindle for passing ventilation gas parallel to the first polishing pad when the first polishing pad extends between the first supply spindle and the first take-up spindle.

25. An apparatus for planarizing first and second microelectronic substrates, comprising:

a frame;

a first supply spindle coupled to the frame and positioned to receive a first elongated polishing pad;

a first take-up spindle coupled to the frame and positioned to receive a used portion of the first elongated polishing pad;

a second supply spindle coupled to the frame and positioned to receive a second elongated polishing pad;

a second take-up spindle coupled to the frame and positioned to receive a used portion of the second elongated polishing pad; and

a platen unit positioned between the take-up spindles and the supply spindles, the platen unit having a first generally flat support surface between the first supply spindle and the first take-up spindle, the platen unit further having a second generally flat support surface facing opposite the first support surface between the second supply spindle and the second take-up spindle.

26. The apparatus of claim 25 wherein the platen unit includes a single platen having the first support surface facing generally opposite the second support surface.

27. The apparatus of claim 25 wherein the platen unit includes a first platen having the first support surface and a second platen proximate to the first platen having the second support surface.

28. The apparatus of claim 25, further comprising:

a first substrate carrier having a first engaging surface proximate to the first polishing pad for engaging a first microelectronic substrate; and

a second substrate carrier having a second engaging surface proximate to the second polishing pad for engaging a second microelectronic substrate.

29. The apparatus of claim 28 wherein the first and second substrate carriers are coupled to a single actuator for moving the substrate carriers in cooperation with each other relative to the first and second polishing pads.

30. The apparatus of claim 28 wherein the first substrate carrier is coupled to a first actuator for moving the first substrate carrier relative to the first polishing pad, further wherein the second substrate carrier is coupled to a second actuator for moving the second substrate carrier relative to the second polishing pad and independent of the first substrate carrier.

31. The apparatus of claim 25 wherein the first and second support surfaces of the platen unit are oriented approximately vertically during operation.

32. The apparatus of claim 25 wherein the first supply spindle is positioned above the first take-up spindle.

33. The apparatus of claim 25 wherein the first take-up spindle is coupled to an actuator for rotating the take-up spindle relative to the frame.

34. The apparatus of claim 25, further comprising a ventilation supply port proximate the first supply spindle and a ventilation exit port proximate the first take-up spindle for passing exhaust gas parallel to the first polishing pad when the first polishing pad is supported by the platen unit.

35. A polishing pad cartridge for installation on a planarizing machine having a supply spindle and a take-up spindle spaced apart from the supply spindle by a first distance, the cartridge comprising:

a cartridge frame having a first attachment portion and a second attachment portion spaced apart from the first attachment portion by a second distance, the second distance being approximately equal to the first distance between the supply spindle and the take-up spindle;

a supply roll rotatably coupled to the frame at the first attachment portion;

a take-up roll rotatably coupled to the frame at the second attachment portion; and

an elongated polishing pad having a first end attached to the supply roll and a second end attached to the take-up roll.

36. The cartridge of claim 35 wherein the elongated polishing pad is a fixed abrasive polishing pad that includes a suspension medium and a plurality of abrasive elements fixedly distributed in the suspension medium.

37. The cartridge of claim 36 wherein the supply spindle and the take-up spindle each have projections extending away therefrom and the supply roll and the take-up roll each include apertures configured to receive the projections.

38. The cartridge of claim 35 wherein the polishing pad includes polyurethane.

39. The cartridge of claim 35 wherein the supply roll includes an axle having a portion extending beyond an edge of the polishing pad and the first attachment portion of the frame includes an opening sized to rotatably receive the portion of the axle.

40. A polishing pad cartridge for installation on a planarizing machine having a supply spindle and a take-up spindle spaced apart from the supply spindle by a first distance, the cartridge comprising:

a supply roll having a first aperture for receiving the supply roll spindle;

a take-up roll having a second aperture for receiving the take-up roll spindle; and

an elongated polishing pad having a first end attached to the supply roll and a second end attached to the take-up roll, the elongated polishing pad being at least partially coiled on the supply roll, the take-up roll being movable relative to the supply roll to separate the first and second apertures by a second distance approximately equal to the first distance while the polishing pad is attached to the supply roll and the take-up roll.

41. The cartridge of claim 40 wherein the elongated polishing pad is a fixed abrasive polishing pad that includes a suspension medium and a plurality of abrasive elements fixedly distributed in the suspension medium.

42. The cartridge of claim 40 wherein the supply spindle and the take-up each have projections extending away therefrom and the supply roll and the take-up roll each include apertures configured to receive the projections.

43. The cartridge of claim 40 wherein the polishing pad includes polyurethane.

44. An apparatus for planarizing a microelectronic substrate, comprising:

a platen having a support surface for supporting a planarizing medium;

a planarizing medium supported by the support surface of the platen, the planarizing medium having a planarizing surface opposite the support surface for engaging the microelectronic substrate;

a carrier at least proximate to the planarizing surface of the planarizing medium, the carrier having at least one engaging surface for engaging the microelectronic substrate and biasing the microelectronic substrate against the planarizing medium, at least one of the carrier and the planarizing medium being movable relative to the other to remove material from the microelectronic substrate;

an at least partially gas-tight enclosure around the carrier and the planarizing medium, the enclosure having an entrance port for admitting ventilating gas to the enclosure and an exit port for removing the ventilating gas from the enclosure, at least one of the entrance port and the exit port being coupleable to a gas propulsion device for moving the ventilating gas relative to the enclosure; and

a controller operatively coupled to a flow path of the ventilating gas to control at least one of a pressure within the enclosure and a flow rate of the ventilating gas through the enclosure.

45. The apparatus of claim 44 wherein the planarizing medium includes a polishing pad having abrasive particles fixedly dispersed therein.

46. The apparatus of claim 44 wherein the gas propulsion device includes a fan.

47. The apparatus of claim 44 wherein the planarizing surface of the planarizing medium is oriented at a non-zero angle relative to horizontal.

48. The apparatus of claim 44 wherein the controller is electrically coupled to the gas propulsion device.

49. A method for removing material from a microelectronic substrate, comprising:

inclining a planarizing surface of a non-continuous polishing pad relative to horizontal;

engaging the microelectronic substrate with the planarizing surface of the polishing pad while the polishing pad is inclined relative to horizontal; and

moving at least one of the polishing pad and the microelectronic substrate relative to the other to remove material from the microelectronic substrate while the polishing pad is inclined relative to horizontal and without moving the polishing pad in a continuous loop between two rollers.

50. The method of claim 49 wherein inclining the planarizing surface includes inclining the planarizing surface to an angle of at least 0.6 degrees relative to horizontal.

51. The method of claim 49 wherein inclining the planarizing surface includes inclining the planarizing surface to be approximately vertical.

52. The method of claim 49 wherein the planarizing medium includes an elongated web coupled at one end to a supply roll and at an opposite end to a take-up roll, further comprising advancing the web over a platen from the supply roll to the take-up roll.

53. The method of claim 52, further comprising positioning the supply roll above the take-up roll.

54. The method of claim 52, further comprising passing the elongated web from the supply roll directly to a platen without passing the web adjacent a guide roller.

55. The method of claim 52, further comprising passing a flow of ventilation gas along an inclined path generally parallel to the planarizing surface.

56. The method of claim 49, further comprising removing selected materials from the planarizing surface by allowing the selected materials to move along an inclined path generally parallel to the planarizing surface under the force of gravity.

57. The method of claim 49, further comprising cleaning the polishing pad by directing a stream of fluid toward the planarizing medium.

58. The method of claim 49, further comprising conditioning the polishing pad by engaging an abrasive end effector with the polishing pad and moving at least one of the end effector and the polishing pad relative to the other to remove material from the polishing pad.

59. A method for removing material from two microelectronic substrates, comprising:

inclining a first planarizing surface of a first planarizing medium relative to horizontal and inclining a second planarizing surface of a second planarizing medium relative to horizontal;

supporting a first microelectronic substrate with a first portion of a substrate carrier and supporting a second microelectronic substrate with a second portion of the substrate carrier;

positioning the substrate carrier between the first and second planarizing media to engage the first microelectronic substrate with the first planarizing surface and engage the second microelectronic substrate with the second planarizing surface while the planarizing surfaces are inclined relative to horizontal; and

moving at least one of the first planarizing medium and the first microelectronic substrate relative to the other and moving at least one of the second planarizing medium and the second microelectronic substrate relative to the other to remove material from the microelectronic substrates while the planarizing media are inclined relative to horizontal.

60. The method of claim 59, further comprising engaging the first planarizing medium with a first support surface of a first platen while engaging the second planarizing medium with a second support surface of a second platen facing generally toward the first platen.

61. The method of claim 59, further comprising:
supporting the first planarizing medium with a first platen; and
supporting the second planarizing medium with a second platen.

62. The method of claim 59 wherein the first planarizing medium includes an elongated polishing pad, further comprising unrolling a portion of the polishing pad from a supply roll and rolling up a portion of the polishing pad on a take-up roll.

63. The method of claim 59, further comprising positioning the supply roll above the take-up roll.

64. The method of claim 59 wherein moving at least one of the first planarizing medium and the first microelectronic substrate relative to the other and moving at least one of the second planarizing medium and the second microelectronic substrate relative to the other includes activating a single actuator to move the substrate carrier relative to both the first planarizing medium and the second planarizing medium.

65. The method of claim 59 wherein inclining the first and second planarizing surfaces includes inclining the planarizing surfaces to be approximately vertical.

66. A method for removing material from two microelectronic substrates, comprising:

inclining a first planarizing surface of a first planarizing medium relative to horizontal and inclining a second planarizing surface of a second planarizing medium relative to horizontal;

supporting the first planarizing medium with a first support surface of a platen unit while supporting the second planarizing medium with a second support surface of the platen unit facing generally opposite the first support surface;

engaging a first microelectronic substrate with the first planarizing medium and engaging a second microelectronic substrate with the second planarizing medium while the planarizing media are inclined relative to horizontal; and

moving at least one of the first planarizing medium and the first microelectronic substrate relative to the other and moving at least one of the second planarizing medium and the second microelectronic substrate relative to the other to remove material from the microelectronic substrates while the planarizing media are inclined relative to horizontal.

67. The method of claim 66 wherein moving at least one of the first planarizing medium and the first microelectronic substrate is simultaneous with moving at least one of the second planarizing medium and the second microelectronic substrate.

68. The method of claim 66 wherein the platen unit includes a first platen having the first support surface and a second platen proximate to the first platen having the second support surface, further wherein supporting the first planarizing medium includes supporting the first planarizing medium with the first platen and supporting the second planarizing medium includes supporting the second planarizing medium with the second platen.

69. The method of claim 66, further comprising biasing the first microelectronic substrate toward the first planarizing medium with a first substrate carrier and biasing the second microelectronic substrate toward the second planarizing medium with a second substrate carrier.

70. The method of claim 69, further comprising moving the first and second substrate carriers independently to remove material from the first and second microelectronic substrates.

71. The method of claim 69 wherein inclining the first and second planarizing surfaces includes inclining the first and second planarizing surfaces of at an approximately vertical angle.

72. The method of claim 69 wherein the first planarizing medium includes an elongated polishing pad, further comprising unrolling a portion of the polishing pad from a supply roll and rolling up a portion of the polishing pad on a take-up roll.

73. The method of claim 72, further comprising positioning the supply roll above the take-up roll.

74. A method for installing an elongated planarizing medium on a planarizing machine, comprising:

installing a supply roll on a supply spindle of the planarizing machine while the elongated planarizing medium is attached to both the supply roll and a take-up roll; and

installing the take-up roll on a take-up spindle of the planarizing machine while the elongated planarizing medium is attached to both the supply roll and the take-up roll.

75. The method of claim 74 wherein the supply roll and the take-up roll are coupled with a frame, further wherein installing the supply roll is simultaneous with installing the take-up roll.

76. The method of claim 74 wherein installing the supply roll and installing the take-up roll are completed without passing the elongated planarizing medium adjacent a guide roller positioned between the supply roll and a platen for supporting the planarizing medium.